the male birds, in hurrying on, are in any way conscious of this particular end to be attained. Mr. Howard knows well that the sexual organs of these males are beginning to be enlarged before migration, *i.e.* the sexual impulse lies behind the whole operation. If the females of these species are weaker in vitality at the time of migration, this might be enough (as Darwin, I think, thought) to account for the earlier arrival of the males. More convincing is Mr. Howard's oft-repeated assertion that he has seen nothing in these territories to support the theory of sexual selection. What seems to happen is this: a male arrives and takes possession of a territory, and sings vigorously, awaiting a female. If another male intrudes, either before or after the appearance of the female, fights ensue and the intruder is driven out, but there is no indication that the female ever chooses between two males. The song and the strange antics (of which the book contains many beautiful drawings) are the result of sexual emotion, but are not the result of rivalry with another individual. The object is rather to overcome the coyness of the female—which reminds me of Mr. Crawley's theory of a similar phenomenon among primitive human beings, only to be overcome by a ceremony, *i.e.* marriage. This view of the bird's emotional antics leads Mr. Howard to another theory, viz., that the instinct known as "shamming wounded" is only an emotional display of the same kind. In this he was in part anticipated by Mr. W. H. Hudson, who, in his "Birds in a Village" (p. 64, *cp.* "Naturalist in La Plata," chap. xv.), explained the nearly related death-feigning instinct by actual paralysis of the nervous system. More careful observation, combined with physiological knowledge, is needed here. Yet another interesting problem is discussed in connection with the blackcap and marsh warbler, viz., the imitative faculty in song, where the mystery consists in the fact that birds of the year seem to be able to make these imitations without having ever heard the songs which they mimic.

I have perhaps said enough to give some idea of the importance of this contribution to our knowledge of the life of these warblers, and of the urgent need of the embodiment of some of its main conclusions in a cheaper form. I will conclude this notice by congratulating the author on having written the first complete account of the marsh warbler and its life during the breeding season. It is, perhaps, a pity that he should have cumbered this account by a preliminary twenty pages of somewhat obscure biological discussion, which might have formed an appendix or a chapter by itself; but when he is telling what he has himself seen of this charming species, nothing could be better. Only on one or two small points does my experience differ from his. He believes that this bird originally built in reeds like the reed warbler, on no other ground that I can discover but that the nest is sometimes hung in its supporting plants after the fashion of that closely allied species. I do not for a moment doubt his statement, but during my long experience of marsh warbler nests, both in England and abroad, I have never seen one that I could not recognise as such at once. One other point I would contest with him. I believe it to be quite impossible that this species should have been freely distributed in England and yet undiscovered up to the middle of the last century; surely the extraordinary brilliancy of the song is sufficient proof of this. The nest, too, is by no means hard to find, yet among old collections the only undoubted marsh warbler's egg I have ever seen is one found in Somerset some sixty-five years ago, which is now in the possession of the Rev. O. Pickard-Cambridge, of Bloxworth. I am strongly of opinion that the bird has long been, and still is, *slowly* increasing its range.

W Warde Fowler.

EDINBURGH MATHEMATICAL TRACTS.

(1) *A Course in Descriptive Geometry and Photogrammetry for the Mathematical Laboratory.* By E. L. Ince. Pp. viii+79. (London: G. Bell and Sons, Ltd., 1915.) Price 2*s*. 6*d*. net.

(2) *A Course in Interpolation and Numerical Integration for the Mathematical Laboratory.* By D. Gibb. Pp. viii+90. (London: G. Bell and Sons, Ltd., 1915.) Price 3*s*. 6*d*. net.

(3) *Relativity.* By Prof. A. Conway. Pp. 43. (London: G. Bell and Sons, Ltd., 1915.) Price 2*s*. net.

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(5) *A Course in the Solution of Spherical Triangles for the Mathematical Laboratory.* By H. Bell. Pp. viii+66. (London: G. Bell and Sons, Ltd., 1915.) Price 2*s*. 6*d*. net.

(6) *An Introduction to the theory of Automorphic Functions.* By L. R. Ford. Pp. viii+96. (London: G. Bell and Sons, Ltd., 1915.) Price 3*s*. 6*d*. net.

THE publication of this series may be taken to show that the experiment of issuing tracts on advanced mathematical subjects has been a success. The field is so wide that there is no serious risk of overlapping, especially if the

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different publishers will announce their programme as soon as they can. Sir George Greenhill, as a veteran tractarian, ought to be personally interested in these successors of his tract on the calculus.

The present series, so far, deals mainly with practical affairs—fortunately not without regard to theory; four of the six tracts are said to be "for the mathematical laboratory." It is to be hoped that this term will not be hackneyed: it is not very happy, in any case, for "a mathematical laboratory" ought to include any place where mathematical experiments are carried on, and experiments are more important than methods of computation. "Number-room" would be shorter and more descriptive; but let that pass, and let us go on to summarise the contents of this parcel.

(1) This has the merit of appreciating the work of Monge, in many ways the greatest master of orthogonal descriptive geometry. The introduction is interesting, though rather amorphous; for instance, the article on "laboratory methods" would have found a better place at the beginning of chapter ii. This chapter deals with a good number of the really fundamental problems on lines and planes; chap. iii. on curved surfaces and space-curves is of a more familiar and less valuable type; chap. iv. is on perspective, and, though very brief, gives some useful hints; chapter v. is on photogrammetry, and the most novel of all. The weakest point in the tract is that nothing is said about dealing with lines that do not meet on the paper; theoretically this is unimportant, but in a drawing-office it is another matter, and auxiliary vanishing points have to be used frequently.

(2) So far as we can judge, this seems to be very well done. There is an outline of the theory of finite differences, the classical formulæ of Simpson, Lagrange, Gauss, etc., and a number of worked and unworked examples. In another edition it might be worth while to give the constants required for Gauss's method (p. 88) in the form of decimals as well as in that of surds.

(3) It is difficult to say what will be the ultimate physical way of stating the principle of relativity, but, thanks chiefly to Minkowski, the mathematical theory is assuming a simple invariant form. The four chapters of this tract deal respectively with Einstein's formulæ, transformation of electromagnetic equations, applications to electron theory, and Minkowski's transformation. Criticism of a physical nature must be left to others; the purely mathematical treatment seems to be all that can be desired. Unfortunately there are very few references—not even one to Minkowski's papers. Without references, a tract cannot perform its proper service as an introduction to an important subject.

(4) This is perhaps the most interesting of the "laboratory" tetrad. The subject being limited, the author is able to give a detailed account, with good examples, of the way in which an irregular periodic graph can be reduced to its harmonic constituents. For work on electric oscillations this tract ought to be very useful. There is also a chapter on spherical harmonics.

(5) This will appeal to astronomers and ordnance survey people, and sailors. The main novelty is the last chapter, on graphical methods, which gives an account of the ingenious inventions of D'Ocagne, Chauvenet, and others. There are numerous examples, worked out to seven places; and others unsolved for the practice of the reader.

(6) This is an excellent tract on what is now an extensive subject. The main points are very clearly put; room has even been found for an outline of non-Euclidean geometry, and the expression of co-ordinates of points on an algebraic curve as one-valued functions. There is a bibliography which seems to include most of the books and papers of really first-rate importance; and there is a sufficient number of diagrams. English-speaking students ought now, at any rate, to appreciate Poincaré's wonderful discoveries in this field.

Mathematicians owe a special debt to Prof. Whittaker for the work he is doing in connection with this series; his encouragement and help are acknowledged in handsome terms by several of the authors.

G. B. M.

OUR BOOKSHELF.

Evolution. By J. A. S. Watson. Pp. vii + 153. (London: T. C. and E. C. Jack, 1915.) Price 5*s*. net.

THE object of this work is apparently to provide, in small compass and with copious illustrations, an account of evolution from the lowest forms of life to man. "The Evidence for Evolution" forms the subject-matter of the first chapter, in which well-chosen lines of argument are briefly laid down and illustrated. The three succeeding chapters treat respectively of "Unicellular and Multicellular Animals," "The Worms and some of their Posterity," and "The Early Vertebrates and the Fishes." The fifth, "The Conquest of the Land," leads on to the sixth and concluding chapter, "The Mammals and Man." The illustrations, 146 in number, are largely borrowed from German sources, although the author is wrong in attributing the bust of *Homo primigenius* (Fig. 145) to a German sculptor. It was modelled by an American lady, daughter of Alphæus Hyatt, who will be affectionately remembered by many British

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